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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/725,325

12/01/2003

Fwu-Iuan Hshieh

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11/23/2004

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EXAMINER

LOKE, STEVEN HO YIN

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/725,325

Applicant(s)

HSHIEH ET AL.

Examiner

Steven Loke

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 August 2004 and 15 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18, 19 and 22-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 18, 19, 22, 23, 26 and 27 is/are rejected.
- 7) ☒ Claim(s) 24 and 25 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

1. Claims 19, 25 and 27 are objected to because of the following informalities:

Claim 19, line 3, the phrase "said epitaxial region" has no antecedent basis. Claim 25, line 17, the phrase "(c)" should change to "(d)" because there is a "(c)" in line 16. Claim 27, line 2, the phrase "said semiconductor substrate" has no antecedent basis.

Appropriate correction is required.

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 18, 19, 22, 23 and 26 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Yang (IDS filed on 12/1/03).

In regards to claim 18, Yang shows all the elements of the claimed invention in figs. 3a to 3f. It discloses a method of forming a trench MOSFET device, comprising: providing a substrate [52] of a first conductivity type (n-type); depositing an epitaxial layer [53] of said first conductivity type over said substrate, said epitaxial layer having a lower majority carrier concentration than said substrate; forming a body region [57] of a second conductivity type (p-type) within an upper portion of said epitaxial layer; etching a trench [71] extending into said epitaxial layer from an upper surface of said epitaxial layer, said trench extending to a greater depth from said upper surface of said epitaxial layer than does said body region; forming a doped region [62] of said first conductivity type between a bottom portion of said trench and said substrate, said doped region having a majority carrier concentration that is lower than that of said substrate and

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higher than that of said epitaxial layer (col. 5, line 59 to col. 6, line 8), wherein said doped region [62] is diffused and spans 100% of the distance from said trench bottom portion to said substrate; forming an insulating layer [60, 63] lining at least a portion of said trench; forming a conductive region [64] within said trench adjacent said insulating layer; and forming a source region [58] of said first conductivity type within an upper portion of said body region [57] and adjacent said trench.

In regards to claim 19, Yang further discloses said step of forming said doped region [62] comprises: (a) implanting a dopant of said first conductivity type into said epitaxial layer [53]; and (b) diffusing dopant of said first conductivity type at elevated temperature (col. 5, lines 44 to 47).

In regards to claim 22, Yang further discloses said first conductivity type is n-type conductivity and said second conductivity type is p-type conductivity.

In regards to claim 23, Yang further discloses said dopant is phosphorous.

In regards to claim 26, Yang inherently discloses said trench MOSFET device is a silicon device.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yang in view of Bulucea et al. (IDS filed on 12/1/03).

In regards to claim 27, Yang further discloses forming a metallic source contact adjacent an upper surface of the source region [58]; and forming a metallic drain contact adjacent said substrate [52, 54].

Yang differs from the claimed invention by not showing forming a metallic gate contact adjacent an upper surface of said conductive region remote from said source region.

Bulucea et al. show forming a metallic gate contact [43a] adjacent an upper surface of said conductive region [36a] remote from said source region [28] in fig. 31A.

Since both Yang and Bulucea et al. teach a MOSFET with a gate electrode, it would have been obvious to have the metallic gate contact of Bulucea et al. in Yang because it provides connection between the semiconductor device and the external circuit.

6. Claim 25 would be allowable if rewritten or amended to overcome the objection set forth in this Office action.

7. Claim 24 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: The major difference in the claims not found in the prior art of record is the step of implanting a dopant of said first conductivity type through the trench mask.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven Loke whose telephone number is (571) 272-1657. The examiner can normally be reached on 7:50 am to 5:20 pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

sl
November 18, 2004

Steven Lohs
Primary Examiner

